Stoller
Grand Junction Office established 1959

299-E33-23 (A6857)
Log Data Report
(REVISED)

Borehole Information:

Borehole: 299-E33-23 (A6857)			Site: 216-B-46 Crib		
Coordinates (WA State Plane)		GWL[1] (ft): 230.9		GWL Date: 12/01	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
137,695 m	573,617 m	09/65	632.64	230.0	cable tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel (welded)	3.3	6.625	6.065	0.28	0	230
Steel (welded)	3.2	4.50	4.026	0.237	0	213

Borehole Notes:

The casing depth information provided above is derived from a well construction and completion summary obtained from Ledgerwood (1993). The casing size information for the 4-in. and 6-in. steel casings is confirmed from tape and caliper measurements collected in the field by Stoller personnel. The groundwater level, measured at 230.9 ft from the TOC by Stoller personnel, is reported to have been at 222 ft from ground surface in 1965 (Ledgerwood 1993). The coordinates and TOC elevation are derived from HWIS[3].

This borehole originally was drilled in 1965. A 6-in. casing had reportedly been placed to 230 ft in depth to the bottom of the borehole. In 1979, a cement plug was placed in the bottom of the borehole and the 6-in. casing was perforated at two cuts per foot from 0 to 208 ft and at one cut per foot from 218 to 230 ft. A 4-in. casing was introduced inside the 6-in. casing to a depth of 217 ft. A packer was set at a depth of 213 ft and grout was placed between the 4-in. and 6-in. casings from the ground surface to the depth of the packer.

Logging Equipment Information:

Logging System:	Gamma 1D		Type: SGLS (35%)
Calibration Date:	07/01	Calibration Reference:	GJO-2001-243-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 1C		Type: HRLS
Calibration Date:	02/02	Calibration Reference:	GJO-2002-309-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	12/20/01	12/26/01	12/27/01		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	232.0	165.0	74.0		
Finish Depth (ft)	164.0	73.0	4.0		
Count Time (sec)	200	200	200		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	n/a[4]	n/a	n/a		
Pre-Verification	A0063CAB	A0064CAB	A0065CAB		
Start File	A0063000	A0064000	A0065000		
Finish File	A0063068	A0064092	A0065070		
Post-Verification	A0063CAA	A0064CAA	A0065CAA		

High Rate Logging System (HRLS) Log Run Information:

Log Run	1	2 Repeat	3	4	5
Date	11/19/02	11/19/02			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	19.0	45.0			
Finish Depth (ft)	52.0	50.0			
Count Time (sec)	100	300			
Live/Real	L	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	n/a	n/a			
Pre-Verification	AC046CAB	AC046CAB			
Start File	AC047000	AC047034			
Finish File	AC047033	AC047039			
Post-Verification	AC047CAA	AC047CAA			

Logging Operation Notes:

Spectral gamma logging was performed in this borehole during December 2001 (SGLS) and November 2002 (HRLS). Logging was conducted without a centralizer on the sonde because the borehole diameter was too small. Logging measurements are referenced to the top of the 6-in. casing. A repeat section was collected in this borehole with the HRLS.

Analysis Notes:

Analyst:	Henwood	Date:	12/11/02	Reference:	GJO-HGLP 1.6.3, Rev. 0

This Log Data Report is a revision of the report originally issued 2/12/02. This revision includes high-rate data analysis results that were not previously reported and replaces the original Log Data Report.

Pre-run and post-run verifications of the SGLS were performed for each day's log event. The efficiency (peak counts per second) of the logging system was consistently lower each day in the post-run verification as compared to the pre-run verification. This change was generally in the range of 6 to 13 percent. The cause of this discrepancy is being investigated. Evaluation of the spectra indicates the detector is functioning normally and the log data are provisionally accepted, subject to further review and analysis. Verification measurements for the HRLS passed acceptance criteria. The post-run verifications were used for the energy and resolution calibration necessary to process the data.

Casing corrections for 0.280-in. and 0.237-in.-thick casings were applied for the 6-in. and 4-in. steel casings, respectively. These values are within the error of the field measurements collected to confirm casing size and represent the published thicknesses for ASTM schedule-40 steel pipe, a common borehole casing at Hanford. Where more than one casing exists at a depth the casing correction is additive (e.g., a 6-in. and 4-in. casing would be the correction for 0.280 + 0.237 = 0.517).

Each spectrum collected during a log run was processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1dcalc4.xls and G1cFeb02.xls for the SGLS and HRLS, respectively, using an efficiency function and corrections for casing and dead time as appropriate. Where SGLS dead time is greater than about 40 percent, pulse pileup and peak spreading effects tend to result in underestimation of peak count rates. HRLS data are substituted in these situations. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations rather than the ^{214}Bi peak at 609 keV. The higher energy 1764-keV energy peak exhibits slightly better count rates than the 609-keV peak because of less gamma attenuation caused by the dual casings in this borehole.

The man-made radionuclide concentrations determined from the SGLS and Westinghouse Corp. Radionuclide Logging System (RLS) were decayed to the date of the HRLS logging event in 11/19/02.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs and ^{60}Co) detected in the borehole, naturally occurring radionuclides (^{40}K, ^{238}U, ^{232}Th [KUT]), a combination of man-made, KUT, and dead time, total gamma plotted with dead time, and an HRLS repeat section. In addition, a comparison log plot of man-made radionuclides is provided that compares data collected with the RLS with SGLS and HRLS data. This plot is included to assess the possibility of movement of contaminants in the vadose zone. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections.

Results and Interpretations:

^{137}Cs and ^{60}Co were the man-made radionuclides detected in this borehole; a trace of ^{154}Eu was also detected just below its MDL (0.5 pCi/g) at 82 to 83 ft in depth. ^{137}Cs was detected continuously throughout the borehole at levels that range from about 1 to 100,000 pCi/g. Two separate zones of contamination are noteworthy, one between 21 and 57 ft in a high dead time zone, where the concentrations are approximately 8,000 to 10,000 pCi/g with a maximum of 100,000 pCi/g at 23 ft, and one between 70 and 100 ft where the concentrations are about 1,000 pCi/g. The second zone appears to differ from the first in that the concentration levels are different and ^{60}Co was detected in the lower interval. Below 100 ft, ^{137}Cs and ^{60}Co contamination is continuous to the total depth of the borehole. The engineer's log included in Chamness and Merz (1993) contains readings collected on sediment samples that show the interval from 15 to 90 ft was contaminated at the time of drilling. The interval from 90 to 205 ft showed no contaminated sediments, while at depths of 205, 210, 215, and 220 ft, contamination was observed. The validity of the engineer's log may be questionable; low-level contamination may not have been detectable with the instruments and methods used at the time. On the basis of slightly elevated concentrations, it appears a third zone of contamination could exist in the vicinity of the borehole between 200 ft and the bottom of the borehole. Historical water levels could possibly have risen to the 200-ft level, leaving residual contamination in the sediments as the groundwater receded to the current level at about 230 ft.

The KUT log profiles are essentially featureless. The dual casings and grout result in significant gamma attenuation. On the basis of low ^{40}K concentrations, the depth interval from 165 to 213 ft appears to have been most affected by grout relative to the remainder of the borehole. Above the high-rate zone, apparent

^{40}K activities are about 12 pCi/g. Below the high-rate zone ^{40}K concentrations increase to about 15 pCi/g, suggesting a transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2 occurred somewhere within the high-rate interval.

A comparison log plot of data collected in 1996 by the Westinghouse RLS, 2001 with the SGLS, and 2002 with the HRLS is included. The RLS and SGLS concentration data (^{137}Cs and ^{60}Co) were decayed to the date of the HRLS logging event in November 2002. The comparison between the logging systems suggests no changes in the contaminant profile that would indicate possible contaminant movement. No RLS data below 210 ft are available that can be used for comparison.

A repeat section of HRLS ^{137}Cs concentrations shows good repeatability for depth and concentrations.

References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells,* PNL-8800, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy.

Ledgerwood, R.K. 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection,* WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Inc., Richland, Washington.

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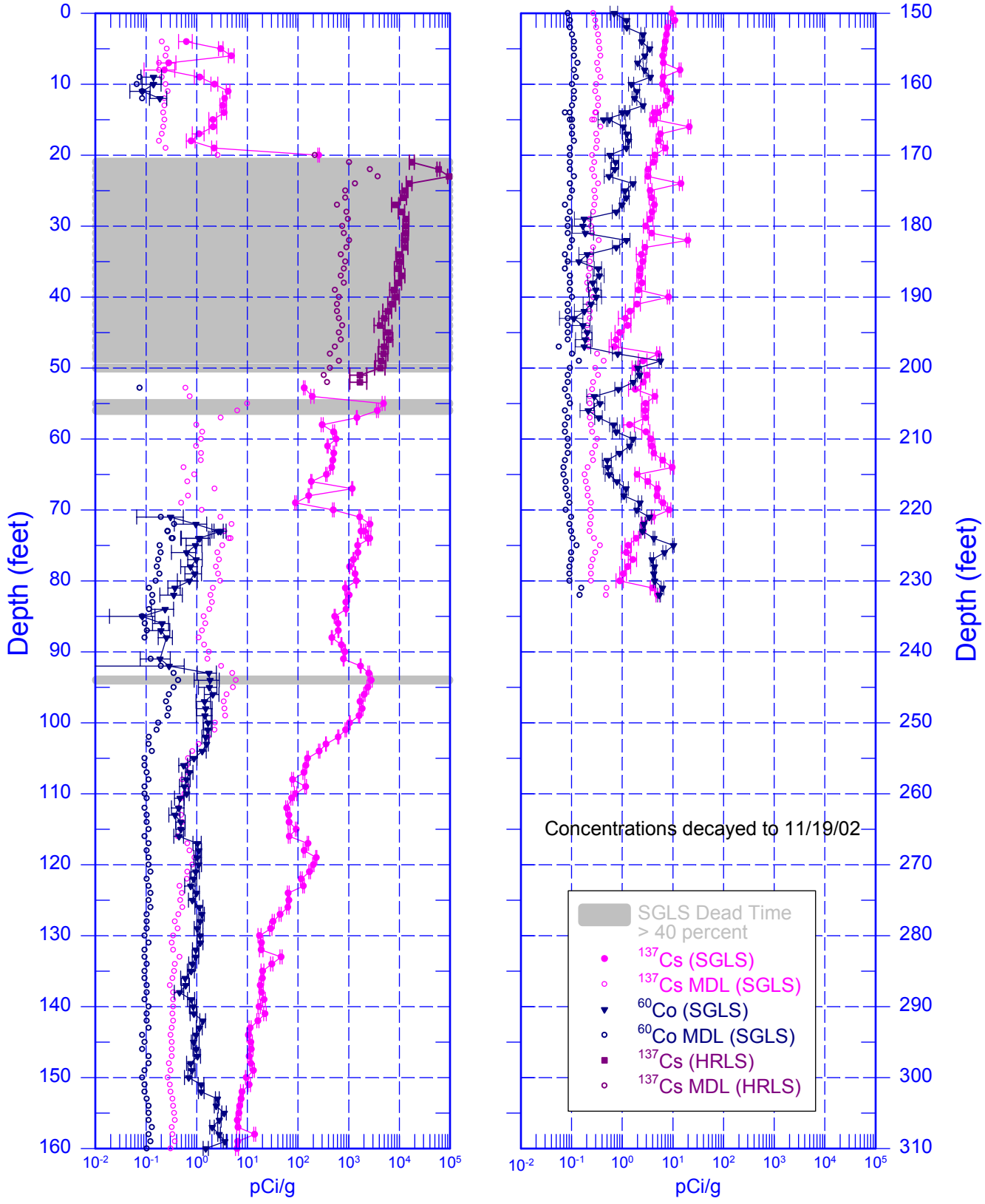
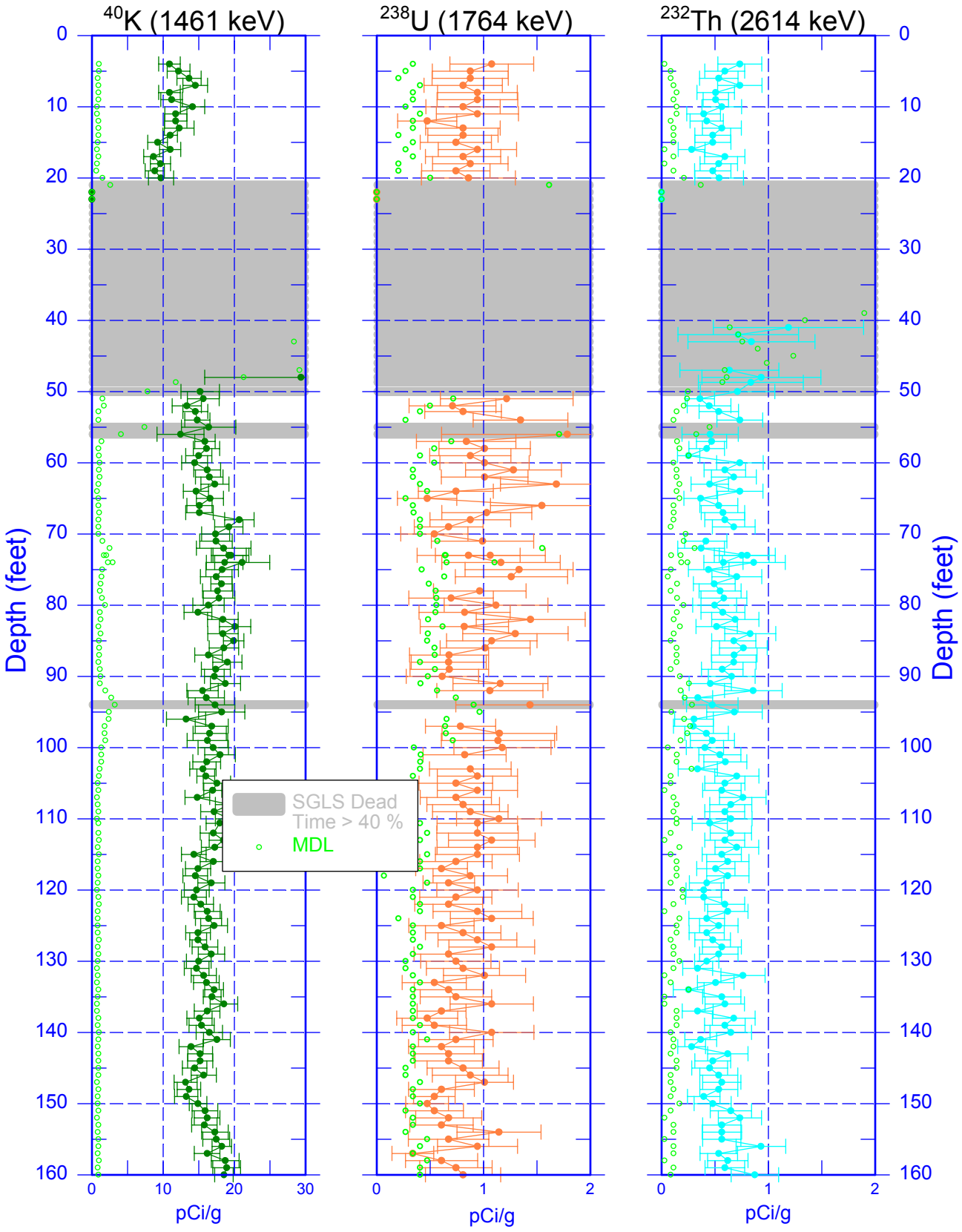
[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] n/a – not applicable

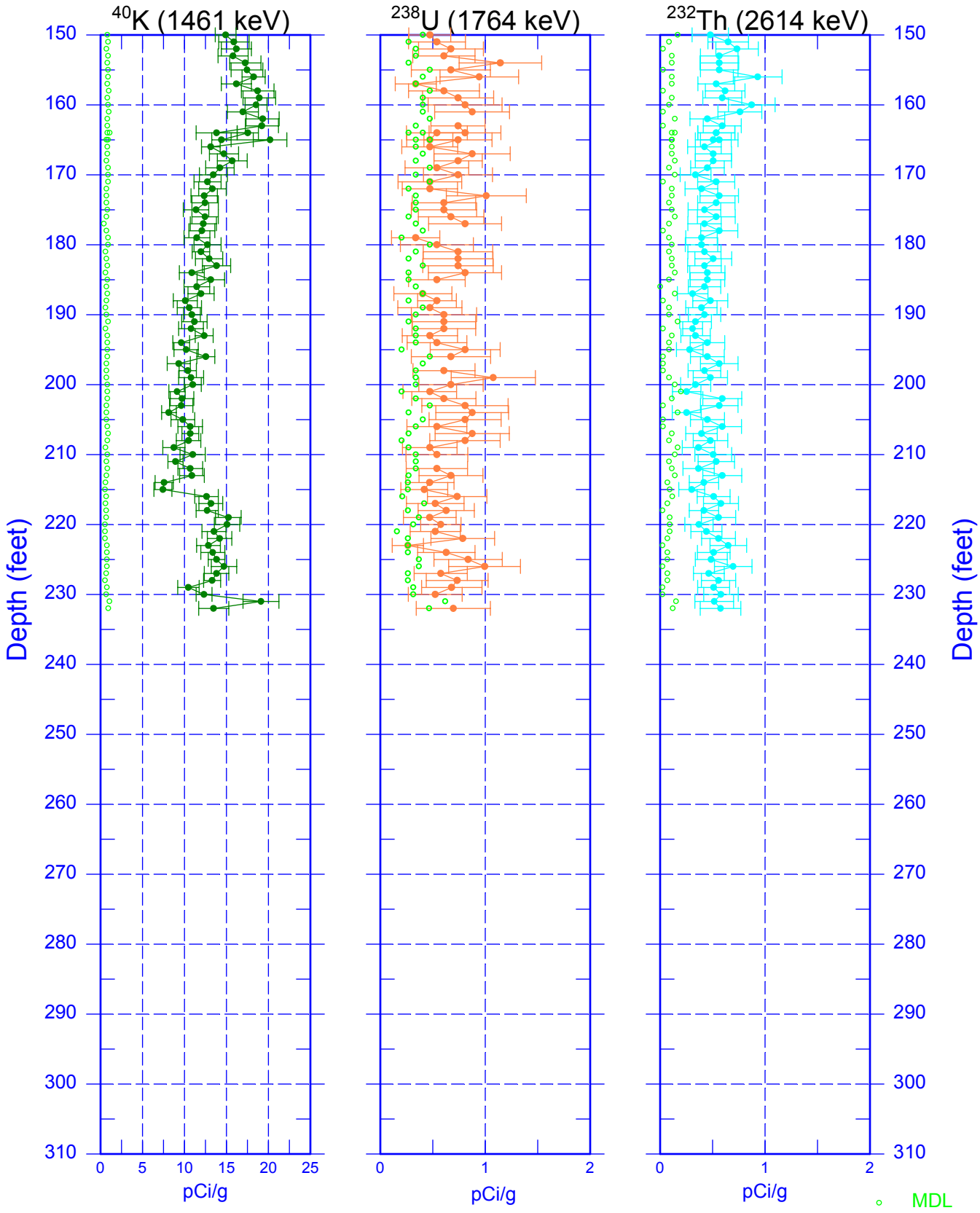
299-E33-23 (A6857)
Man-Made Radionuclide Concentrations



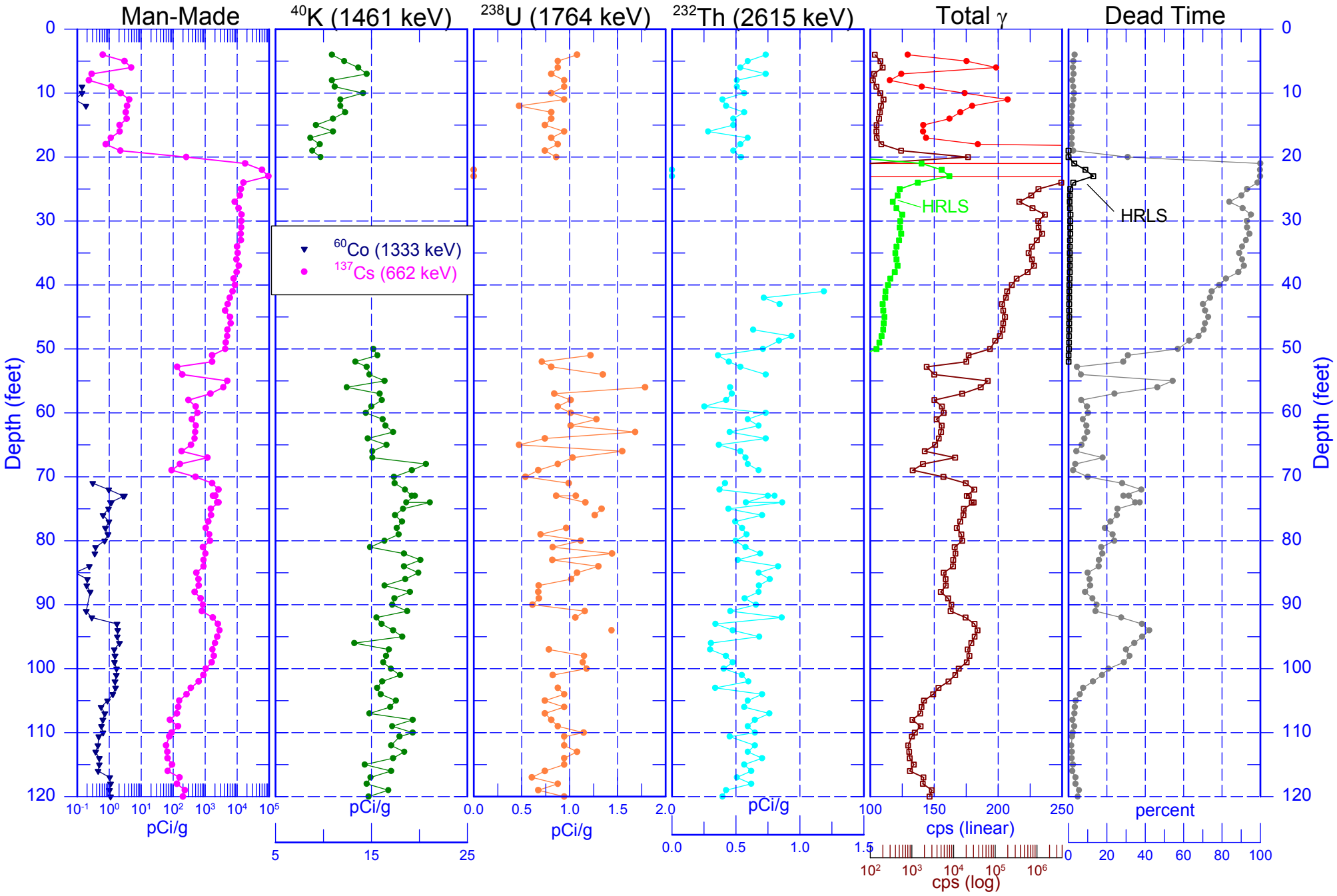
299-E33-23 (A6857)
Natural Gamma Logs



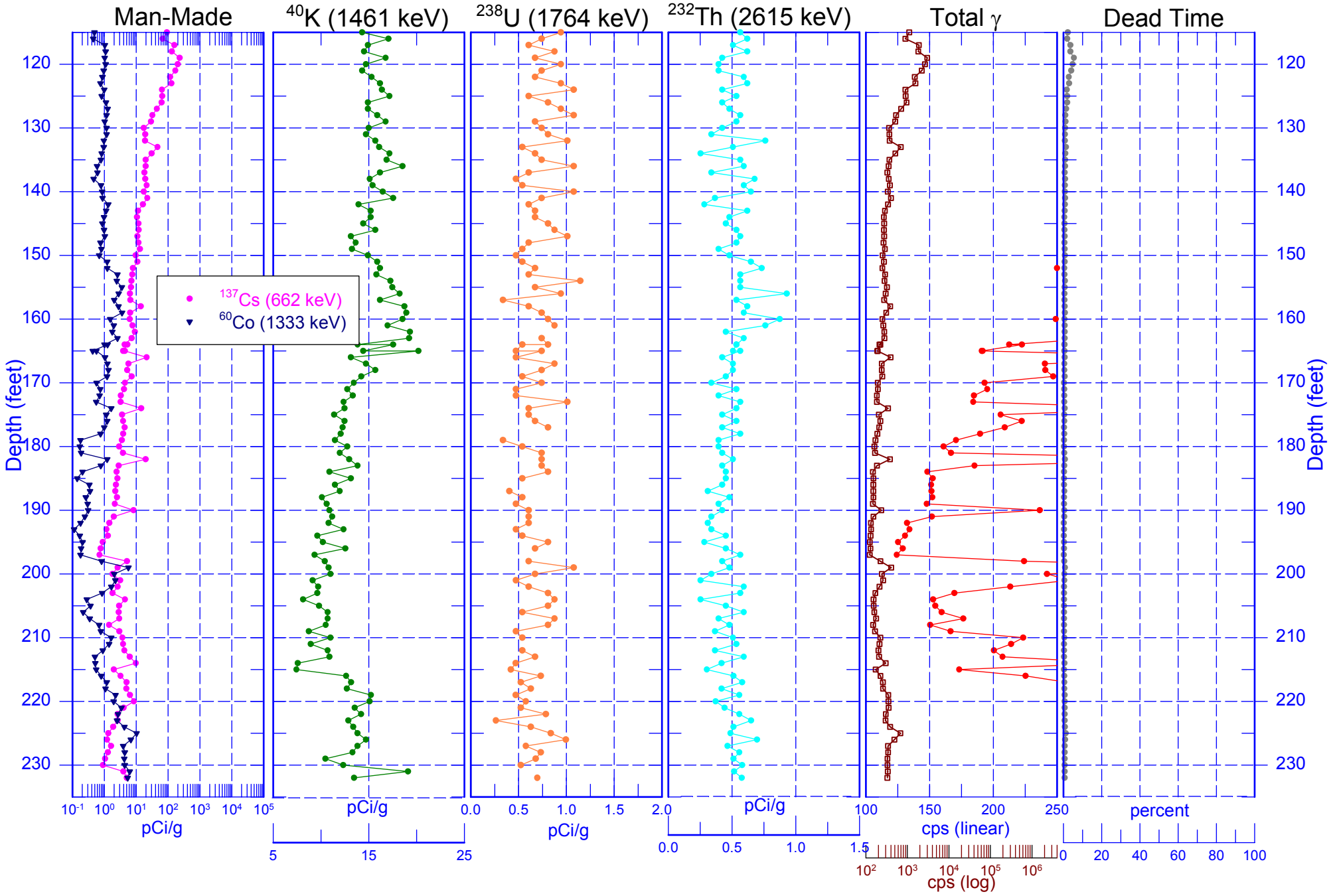
299-E33-23 (continued)
Natural Gamma Logs



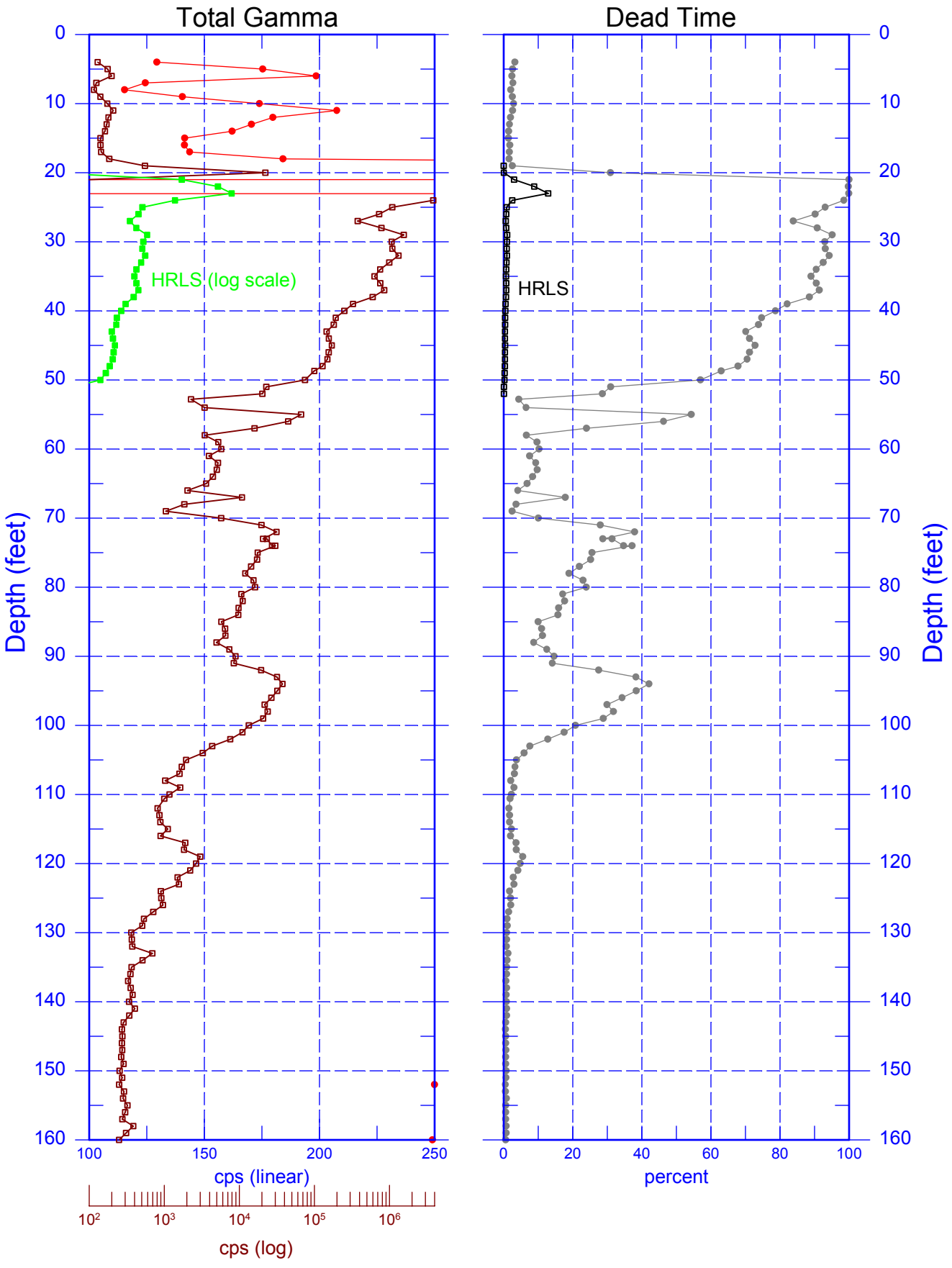
299-E33-23 (A6857) Combination Plot



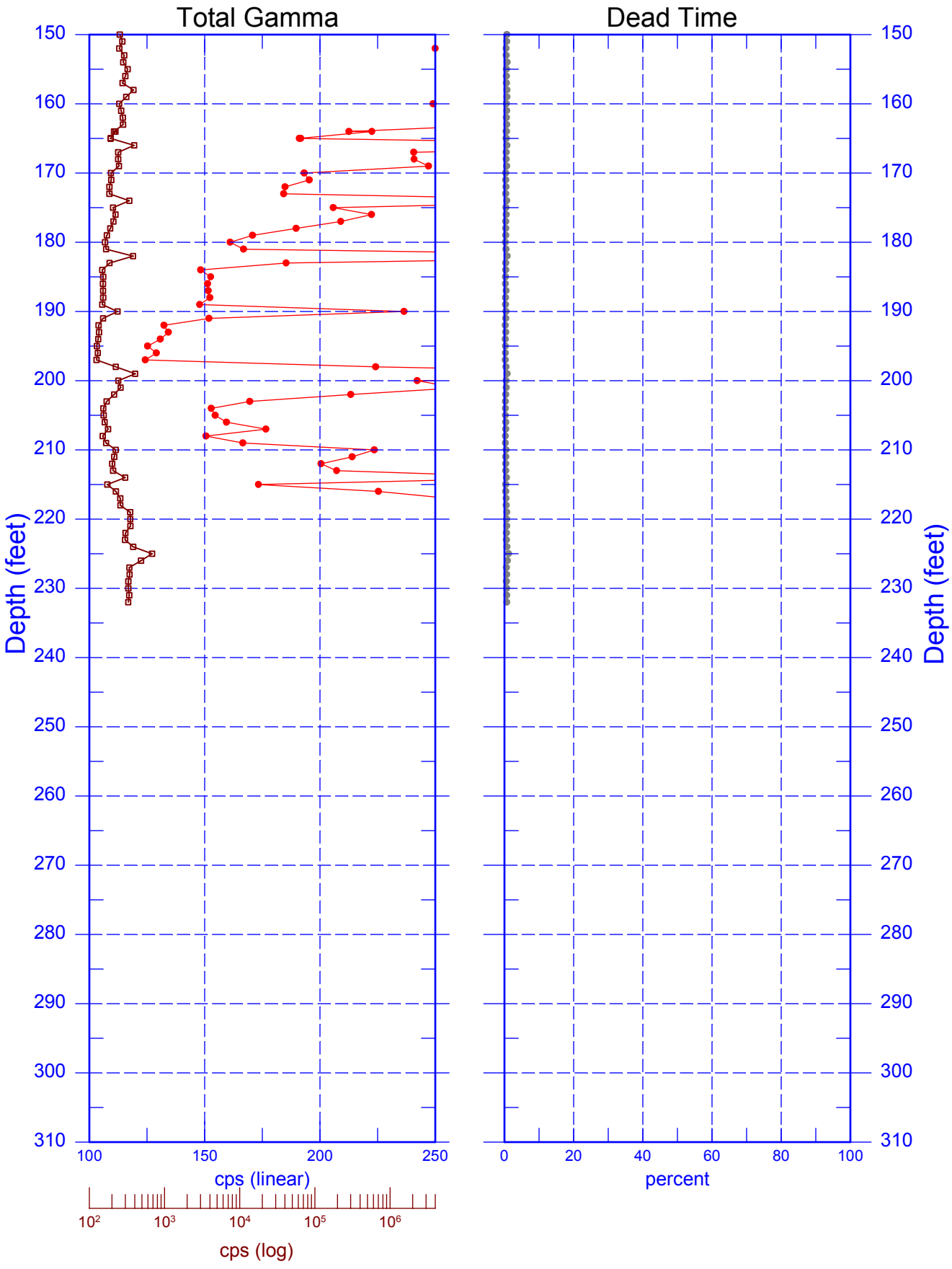
299-E33-23 (A6857) Combination Plot



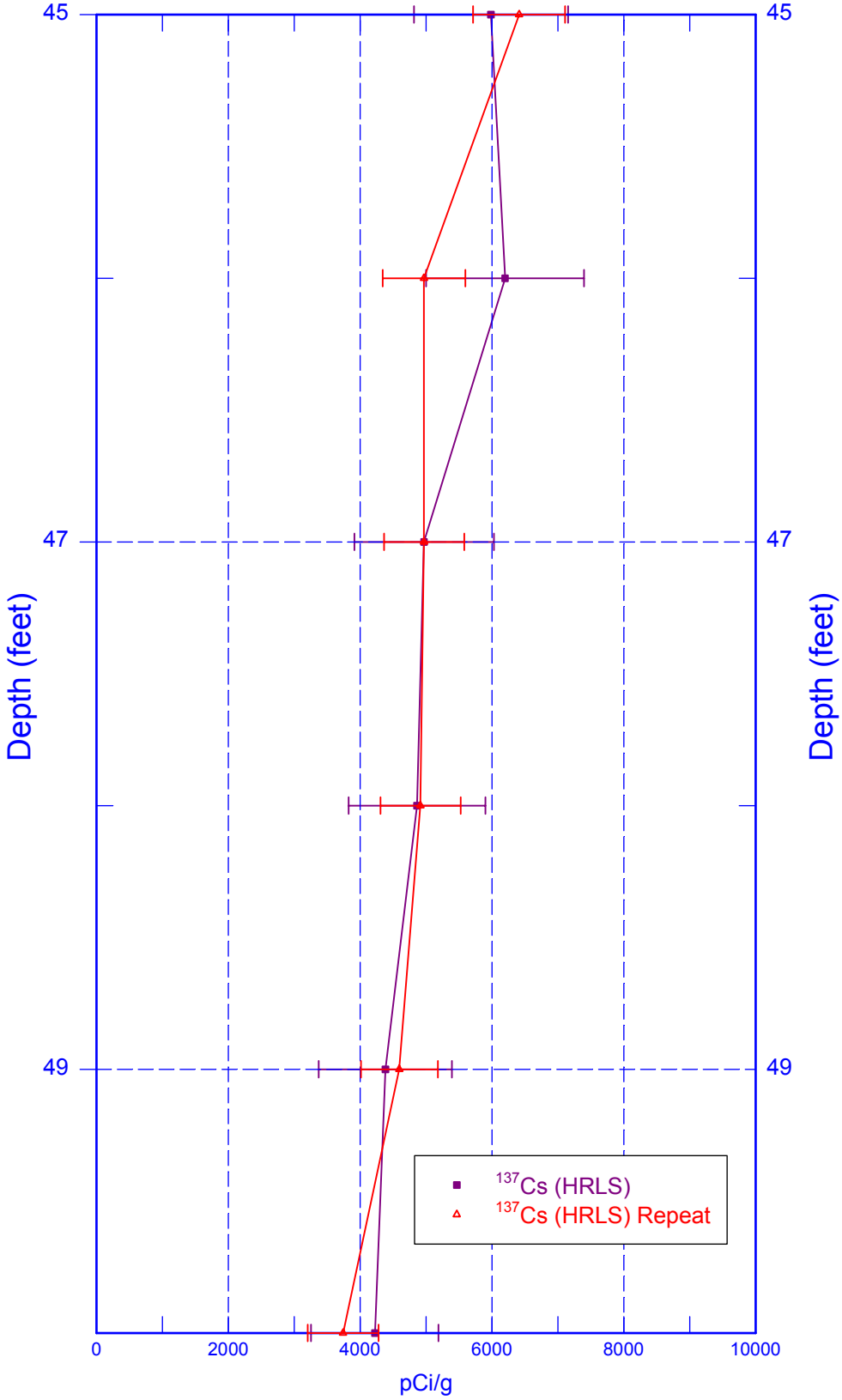
299-E33-23 (A6857)
Total Gamma & Dead Time



299-E33-23 (A6857)
Total Gamma & Dead Time

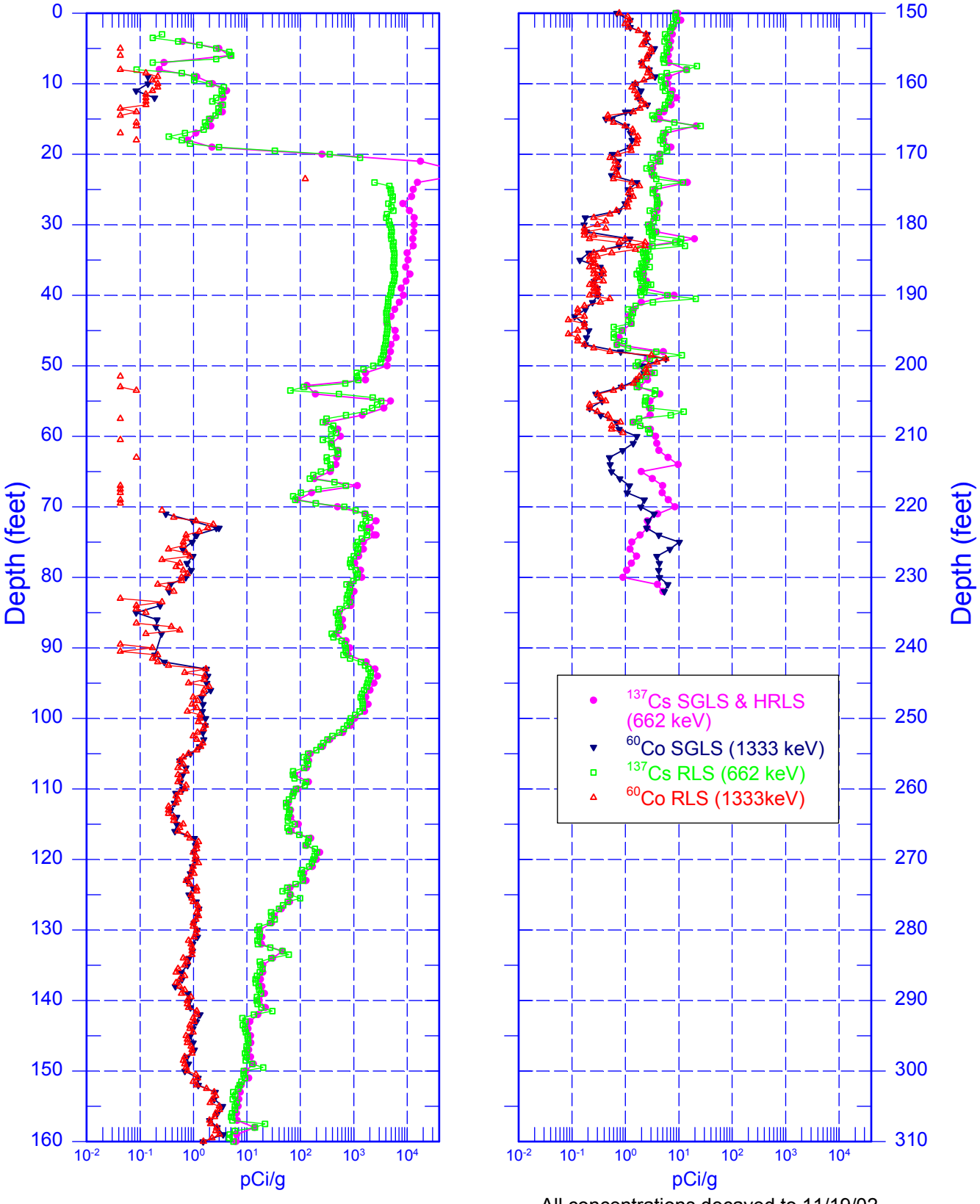


299-E33-23 (A6857)
HRLS Repeat Section



299-E33-23 (A6857)

RLS (1996) and SGLS (2002) Comparison Logs



All concentrations decayed to 11/19/02